

COMPLETE LISTING OF CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claims 1-37 (cancelled)

38. (currently amended) A In a direct expansion ("DX") geothermal heat exchange system, having a DX geothermal heat pump operable ~~ting in a the heating mode and including a sub-surface geothermal heat exchanger, an improvement comprising a supplemental solar heating system including a solar heat collector fluidly connected to a solar heat to direct expansion system refrigerant fluid heat exchanger by fluid transport tubing, wherein solar heat acquired from a~~ the solar heat collector is conveyed by means of a fluid within the fluid transport tubing, and the solar heat is transferred, by the a solar heat to direct expansion system refrigerant fluid heat exchanger means, to the refrigerant fluid in the DX geothermal heat pump ~~a direct expansion system.~~

39. (currently amended) A In a geothermal direct expansion ("DX") heat exchange system, having a DX geothermal heat pump operable ~~ting in a the heating mode and including a sub-surface geothermal heat exchanger, an improvement comprising a supplemental solar heating system including a solar heat collector fluidly connected to a solar heat to direct expansion system refrigerant fluid heat exchanger by transport tubing, wherein solar heat acquired from a~~ the solar heat collector is conveyed by means of a fluid within the transport tubing, and the solar heat is transferred, by a the solar heat to direct expansion system refrigerant fluid

heat exchanger ~~means~~, to the refrigerant fluid immediately prior to the refrigerant fluid entering the sub-surface geothermal heat ~~exchanger~~~~transfer environment of the direct expansion system.~~

40. (currently amended) The system of claim 38 wherein ~~all solar heat the~~ fluid transport ~~tubings~~ between the solar heat collector and the solar heat to refrigerant fluid heat exchanger ~~means~~ ~~is~~are insulated, and wherein the exterior of the solar heat to refrigerant fluid heat exchanger ~~means~~ is insulated.

41. (currently amended) The system of claim 38 wherein the solar heat to refrigerant fluid heat exchanger ~~means~~ is located at an elevation above that of the solar heat collector.

42. (currently amended) The system of claim 38 wherein ~~further comprising a~~ solar heat transfer termination ~~devicemeans is provided~~, which solar heat transfer termination ~~devicemeans~~ is ~~only~~activated ~~only~~ when the DX geothermal heat exchange ~~direct expansion system~~ is operating in ~~a~~ the cooling mode, and during periods of time when ~~the~~ supplemental heat supplied by the solar heat collector is at a lower temperature than ~~a~~ the maximum temperature in the sub-surface geothermal heat exchanger ~~geothermal heat exchange sub-surface environment,~~ and ~~which solar heat transfer termination means is otherwise de-activated.~~

43. (currently amended) A direct expansion geothermal heat exchange system, operating in the heating mode, comprising a supplemental solar heating system wherein heat acquired from a solar heat collector is conveyed by means of a fluid within transport tubing, and the solar heat is transferred, by a solar heat to

direct expansion system refrigerant fluid heat exchange means, to the refrigerant fluid in a direct expansion system, wherein the solar collector's heat transfer tubing is always sloped in an upward vertical orientation from the bottom of the solar heat collector to the top of the solar heat to direct expansion refrigerant fluid heat exchange means, and wherein the solar collector's heat transfer tubing is always sloped in a downward vertical orientation from the top of the solar heat to direct expansion refrigerant fluid heat exchange means to the bottom of the solar heat collector.

44. (currently amended) The system of claim 38 ~~wherein there is further comprising refrigerant tubing fluidly connected to the solar heat to direct expansion refrigerant fluid heat exchanger, the refrigerant tubing including an inverted U bend in the direct expansion heating system's refrigerant transport tubing situated above the solar heat to direct expansion refrigerant fluid heat exchange means.~~

45. (currently amended) ~~The system of claim 38~~ A direct expansion geothermal heat exchange system, operating in the heating mode, comprising a supplemental solar heating system wherein heat acquired from a solar heat collector is conveyed by means of a fluid within transport tubing, and the solar heat is transferred, by a solar heat to direct expansion system refrigerant fluid heat exchange means, to the refrigerant fluid in a direct expansion system, wherein the solar heat to direct expansion refrigerant fluid heat exchange means is situated at a point in the direct expansion system's liquid refrigerant transport line after the direct expansion system's heating mode refrigerant expansion device and before the

point where the direct expansion system's thermally exposed sub-surface refrigerant transport geothermal heat exchange tubing is located.

46. (withdrawn) A closed-loop water-source geothermal heat pump system, operating in the heating mode, comprising a supplemental solar heating system wherein heat acquired from a solar heat collector is conveyed by means of a fluid within transport tubing, and wherein the solar heat is transferred to the one of water and water and antifreeze fluid circulating within the closed-loop water-source geothermal heat pump system by means of one of a solar heat to a water-source system water/antifreeze fluid heat exchange means, and a solar heat to water-source system refrigerant fluid heat exchange means to a water-source system refrigerant fluid to water-source system water/antifreeze fluid heat exchange means.

47. (withdrawn) A closed-loop water-source geothermal heat pump system, operating in the heating mode, comprising a supplemental solar heating system wherein heat acquired from a solar heat collector is conveyed by means of a fluid within transport tubing, and wherein the solar heat is transferred to the one of water and water and antifreeze fluid circulating within the closed-loop water-source geothermal heat pump system by means of one of a solar heat to a water-source system water/antifreeze fluid heat exchange means, and a solar heat to water-source system refrigerant fluid heat exchange means to a water-source system refrigerant fluid to water-source system water/antifreeze fluid heat exchange means immediately before the water-source system's circulating water/antifreeze fluid

enters the sub-surface geothermal heat transfer environment of the water-source system.

48. (currently amended) The system of claim 46 ~~and 47~~ wherein all solar heat fluid transport tubes between the solar heat collector and the one of solar heat to water/antifreeze fluid heat exchange means, and solar heat to refrigerant fluid heat exchange means to a refrigerant fluid to water/antifreeze fluid heat exchange means, are insulated, and where the exteriors of the one of solar heat to water/antifreeze fluid heat exchange means, and solar heat to refrigerant fluid heat exchange means to a refrigerant fluid to water/antifreeze fluid heat exchange means, are insulated.

49. (currently amended) The system of claim 46 ~~and 47~~ wherein the one of a solar heat to water/antifreeze fluid heat exchange means, and solar heat to refrigerant fluid heat exchange means and a refrigerant fluid to water/antifreeze fluid heat exchange means is provided, and wherein the one of solar heat to water/antifreeze fluid heat exchange means, and solar heat to refrigerant fluid heat exchange means, is located at an elevation above that of the solar heat collector.

50. (currently amended) The system of claim 46 ~~and 47~~, wherein a solar heat transfer termination means is provided, which solar heat transfer termination means is only activated when the water-source heat pump heating and cooling system is operating in the cooling mode, and during periods of time in the heating mode when the supplemental heat supplied by the solar heat collector is at a lower temperature than the maximum temperature in the geothermal heat exchange sub-

surface environment, and which solar heat transfer termination means is otherwise de-activated.

51. (currently amended) The system of claim 46 ~~and 47~~ wherein there is an inverted U bend in the water-source heat pump's heating system's one of water/antifreeze fluid transport tubing, and refrigerant fluid transport tubing, which tubing containing the inverted U bend is situated above the one of solar heat to water/antifreeze fluid heat exchange means, and solar heat to refrigerant fluid heat exchange means.

52. (currently amended) The system of claim 46 ~~and 47~~ wherein the solar collector's heat transfer tubing is always sloped in an upward orientation from the bottom of the solar heat collector to the top of the one of the solar heat to water/antifreeze fluid heat exchange means, and solar heat to refrigerant fluid heat exchange means, and wherein the solar collector's heat transfer tubing is always sloped in a downward orientation from the top of the one of the solar heat to water/antifreeze fluid heat exchange means, and solar heat to refrigerant fluid heat exchange means, to the bottom of the solar heat collector.

Claims 53-58. (cancelled)

59. (previously added) A geothermal heat exchange system, operating in the heating mode, comprising:

a geothermal heat pump, the geothermal heat pump including system refrigerant tubing and system refrigerant moving through the refrigerant tubing;

a supplemental solar heating system, the supplemental solar heating system including a solar collector, solar heating transport tubing thermally coupled to the solar collector, and solar heating fluid moving within the solar heating transport tubing;

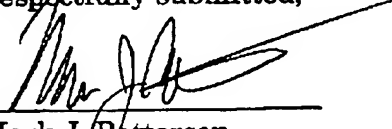
a heat exchanger thermally coupled to the supplemental solar heating system and to the geothermal heat pump; and;

wherein heat acquired from the solar collector is conveyed to the solar heat heating fluid within the solar heating transport tubing, and the solar heat is then transferred by the heat exchanger to the system refrigerant in the system refrigerant tubing.

Applicant submits that this Response to Notice of Non-Compliant Amendment meets the requirements of 37 CFR 1.121.

The Commissioner is authorized to charge any deficiency or credit any overpayment associated with the filing of this Response to Deposit Account 23-0035.

Respectfully submitted,

  
Mark J. Patterson  
Registration No. 30,412  
WADDEY & PATTERSON  
A Professional Corporation  
Customer No. 23456

ATTORNEY FOR APPLICANT